

Cards or cash. How should we pay?

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Inexpensive and easy-to-use payment services promote trade and prosperity. The efficiency of the payment system is thus an important social issue. In this article we give a brief account of the social costs of cash and card payments and discuss how the payment system could be used more efficiently. We find that cash and cards are used relatively efficiently in the Swedish payment system. However, there is potential for further reducing payment costs by using debit cards to a greater extent than today. The payment system could also be used more efficiently if transparent and cost-based charges were introduced. Consumers may find it easier to accept such charges if they are compensated for them and provided with simple and targeted information.

A payment is a transfer of a monetary value from one party to another, often as compensation for a good or a service.¹ When the buyer attaches a higher value to the good or service than the seller a transaction can take place, and both parties will be better off than if no transaction had occurred. However, when the good or service is exchanged for a payment, costs arise for making the payment. These costs are always borne in one way or another by the seller or the buyer.² In practice, this means that it will only be possible to carry out the transaction if the buyer's valuation of the good exceeds the seller's by at least as much as it costs to make the payment. The greater this cost, the fewer the number of potentially mutually favourable transactions that will be carried out. Similarly, lower payment costs contribute to increased trade and, by extension, greater prosperity. It is therefore in the interests of society that expedient and inexpensive payment methods are available.

The aim of this article is to discuss how the use of cards and cash affects efficiency in the Swedish payment system. We begin by discussing different types of payment, their basic characteristics and the difference between private costs and social costs. We then examine the costs for payments using cash and cards in Sweden in more detail and also make international comparisons. Finally, we discuss whether cash and cards are used efficiently and possible measures to increase efficiency.

1 Payments have three different functions in the economy: they make it possible to trade in goods and services, to convert savings to investments and to redistribute financial risks. The term payment as used in this article refers to compensation for goods or services, but in principle the reasoning also applies to payments in other contexts.

2 There is also often a cost for delivering the goods, either directly in monetary terms or, more indirectly, in terms of time and effort. Together with the cost of making the payment, these costs constitute what is usually referred to as a transaction cost. This article focuses on that part of the transaction cost that stems from the payment.

THE DESIGN AND COST STRUCTURE OF THE PAYMENT SYSTEM

At an overall level, there are two types of payment in Sweden: *cash* payments and *account-based* payments. Cash payments are made at the point-of-sale by one of the parties to the transaction handing over the monetary value directly to the other party. In an account-based payment, the transaction is carried out by transferring the monetary value electronically between accounts in special custodial institutions, which are usually commercial banks. Here the banks act as intermediaries for the payment by receiving instructions to transfer a certain sum from one account to another and carrying out the payment without the further involvement of the payer or payee.

Cash payments require considerable manual handling of the cash on the part of both the payer and the payee, but also on the part of banks, cash-in-transit companies and others. Account-based payments, on the other hand, require a financial infrastructure within which payment information is processed. This infrastructure mainly consists of different types of IT system such as online banking systems, card terminals, switches that direct information and clearing platforms.³ In contrast to cash payments, account-based payments usually require little manual work.

A common feature of both types of payment is that they are both associated with considerable *economies of scale*. Setting up a logistical infrastructure to manage the flow of cash in the economy is costly, and it is also costly to develop the financial infrastructure required for account-based payments. However, once the infrastructure is in place, the marginal costs for handling marginally more cash or an additional account-based payment are low. This means that the average cost of a payment of a certain type tends to fall as the number of payments increases. In the case of account-based payments there are also possible synergy effects that further increase the economies of scale in that different types of account-based payment can be wholly or partly processed within the same infrastructure. This reasoning is general and applies to all types of monetary payments in Sweden. However, hereafter we will focus exclusively on payments using cash and cards. These two payment methods can be substituted for one another and are mainly used at the point-of-sale.

Both cash payments and card payments have their advantages and disadvantages. Cash payments transfer the monetary value directly when the cash is handed over and can be a quick and easy-to-use alternative when, for example, making smaller payments at the point-of-sale or for payments between private individuals. In addition, no special infrastructure is required to receive cash payments. A disadvantage from the user's perspective is that cash does not earn interest. The interest that is not earned by the person holding the cash gives rise to the corresponding interest income at the Riksbank. This revenue from the issue of banknotes and coins is called *seignorage*. Other potential disadvantages are that the purchasing power of the cash holder is limited to the amount

³ Clearing is a collective term for the processing of payment information that forms the basis for the exchange of payments between intermediaries.

of cash he or she holds and that there is a risk of counterfeiting. On the other hand, payments made using debit or credit cards give the buyer access to more purchasing power and can be less time consuming when paying somewhat larger amounts.⁴ The potential disadvantages of cards are that they are not accepted everywhere (the infrastructure is lacking), payments cannot be made if there are technical problems and that there is a risk of card fraud, for example skimming.

Different payments are also more or less appropriate in different situations, and the preferences of the user are also to some extent a matter of taste. However, the choice of payment method also governs the cost of the payment and, ultimately, the total cost for payments in Sweden. The lower the transaction cost is, the more efficient trade will be and the greater prosperity will be. Below, we therefore outline the costs for payments using cash, debit cards and credit cards and discuss to what extent the Swedish payment system is used efficiently.

Private and social costs

An important distinction in this context is that between *private costs* and *social costs*. The former are the costs incurred by an agent or a sector, for example the banking sector. These are the costs for the resources consumed by the agent or sector in connection with the payment and the fees they pay to other agents or sectors. For example, the banks pay the cash-in-transit companies for transporting cash and consume their own resources, such as labour and premises, in connection with cash management. A bank's revenues from the sale of payment services can be deducted from these private costs to arrive at the private net cost that represents the bank's profit or loss. The bank can also earn income from the retail trade by receiving daily takings and providing change.

The social costs, on the other hand, reflect the value of the overall resources consumed in connection with a payment, or in total for a certain type of payment, and thus constitute a measure of the value of other goods and services that could otherwise have been produced with these resources. However, the social costs cannot be calculated by adding together the private costs of all the agents involved as this would entail a certain degree of double counting. Chart 1 gives an example of this in the case of cash management.

Chart 1. An example of the difference between private and social costs

| BANK | | CASH-IN-TRANSIT COMPANY | | | | | | | | | | | | | | | | | | | | |
|--|--------------------|-------------------------|----------|-----|---------------|-----|----------------|---|----------|-----|--------------------------------|--|--------------------|-----|----------|---|---------------|-----|----------------|-----|----------|---|
| <table border="1" style="width: 100%; border-collapse: collapse;"> <tr><td>Consumed resources</td><td style="text-align: right;">100</td></tr> <tr><td>Fee paid</td><td style="text-align: right;">100</td></tr> <tr><td style="border-top: 1px solid black;">Private costs</td><td style="text-align: right; border-top: 1px solid black;">200</td></tr> <tr><td>- Fee received</td><td style="text-align: right;">0</td></tr> <tr><td style="border-top: 1px solid black;">Net cost</td><td style="text-align: right; border-top: 1px solid black;">200</td></tr> </table> | Consumed resources | 100 | Fee paid | 100 | Private costs | 200 | - Fee received | 0 | Net cost | 200 | <p>Fee</p> <p>→</p> <p>100</p> | <table border="1" style="width: 100%; border-collapse: collapse;"> <tr><td>Consumed resources</td><td style="text-align: right;">100</td></tr> <tr><td>Fee paid</td><td style="text-align: right;">0</td></tr> <tr><td style="border-top: 1px solid black;">Private costs</td><td style="text-align: right; border-top: 1px solid black;">100</td></tr> <tr><td>- Fee received</td><td style="text-align: right;">100</td></tr> <tr><td style="border-top: 1px solid black;">Net cost</td><td style="text-align: right; border-top: 1px solid black;">0</td></tr> </table> | Consumed resources | 100 | Fee paid | 0 | Private costs | 100 | - Fee received | 100 | Net cost | 0 |
| Consumed resources | 100 | | | | | | | | | | | | | | | | | | | | | |
| Fee paid | 100 | | | | | | | | | | | | | | | | | | | | | |
| Private costs | 200 | | | | | | | | | | | | | | | | | | | | | |
| - Fee received | 0 | | | | | | | | | | | | | | | | | | | | | |
| Net cost | 200 | | | | | | | | | | | | | | | | | | | | | |
| Consumed resources | 100 | | | | | | | | | | | | | | | | | | | | | |
| Fee paid | 0 | | | | | | | | | | | | | | | | | | | | | |
| Private costs | 100 | | | | | | | | | | | | | | | | | | | | | |
| - Fee received | 100 | | | | | | | | | | | | | | | | | | | | | |
| Net cost | 0 | | | | | | | | | | | | | | | | | | | | | |

4 Debit cards are cards where the payment is debited directly from the buyer's bank account. Charge cards are cards where the bank periodically invoices the card holder the total value of the payments. Credit cards give the card holder the opportunity to wait before paying all or parts of the invoiced sum. In this article, we use the term credit card collectively for both credit and charge cards.

In the example in Chart 1, a bank consumes SEK 100 in personnel costs (consumed resources) to sort cash that will be paid back to the Riksbank. The bank then gets a cash-in-transit company to transport the cash to the Riksbank at a cost of SEK 100 (fee paid). The cash-in-transit company's cost for producing the transport service is SEK 100 for personnel, fuel and the depreciation of the vehicle used (consumed resources). At the same time, the company earns income of SEK 100 (fee received). If we ask the bank and the cash-in-transit company to report their costs the bank will report SEK 200 and the cash-in-transit company SEK 100. The private costs will thus total SEK 300 while the total for the resources consumed is SEK 200, and it is the latter sum that is the social cost in this example.

The difference between the private cost and the social cost is thus SEK 100, which is equivalent to the fee paid by the bank to the cash-in-transit company. In order to convert private costs to social costs, one must thus discount the fees that different agents pay to each other. This can be done in two ways: either at the payer (the bank) or at the payee (the cash-in-transit company). If we exclude the fee from the payer we will get the value of the resources consumed by the payer. If we choose instead to include the fee as a negative cost for the payee we will get a net cost that corresponds to the payee's corporate loss or, alternatively, a negative net cost that corresponds to a corporate profit. Note that both total consumed resources and total net costs add up to SEK 200. Both ways thus give the social cost, but how this cost is shared between the parties differs depending on how one chooses to calculate it.⁵ In terms of consumed resources both parties bear a cost of SEK 100, but in terms of net cost the bank bears the entire social cost of SEK 200.

There are of course more than two parties involved in cash and card payments in society as a whole, but the principle is the same as in Chart 1. One has to take into account all the payments between the different agents that relate to the purchase of services between them to arrive at the social costs. The Riksbank's seignorage should also be discounted. For all sectors except the consumers, the costs that we present in this article include costs for various security measures such as credit assessments and losses resulting from fraud in the case of card payments and security features, inspection and losses from counterfeit banknotes and coins.

From an economic perspective, the profit that an agent makes from a fraud and the resulting loss suffered by another agent are regarded as a transfer from one party to another. On the other hand, the cost of the real resources consumed by countermeasures is a social cost. Our calculations do not take into account integrity aspects and the possible costs that, for example, consumers may perceive from knowing that their card payments are registered by the bank, and sometimes by the retailer concerned.⁶

5 Externalities are consequences that affect someone other than those that cause the event concerned. A common example is environmental pollution. For the total in the table to really reflect the social cost one needs to assume that there are no externalities or that the prices paid by the agents on the market fully take into account any externalities.

6 Our analysis differs from a traditional social cost benefit analysis in that we focus on the cost side and do not take into account any social benefits. We thus do not include, for example, the sense of satisfaction or security that consumers feel when paying in cash or by card.

THE COSTS OF CASH AND CARD PAYMENTS

In 2010 and 2011, we collected information on behalf of the Riksbank on the costs of payments made using cash, debit cards and credit cards in 2009. The information was collected from the Riksbank, cash-in-transit companies, banks and consumers. Only payments from consumers to businesses were included.⁷ Table 1 presents the calculated number of payments and the total values for different payment methods.^{8,9}

Table 1. Number and value of cash and card payments from consumers to companies in Sweden in 2009

| | CASH | CARD | | TOTAL |
|--|------------|------------|------------|------------|
| | | DEBIT | CREDIT | |
| Total value (SEK, billions) | 261 | 550 | 123 | 673 |
| Number of transactions (millions) | 1 034 | 1 337 | 240 | 1 577 |
| Average transaction value (SEK) | 252 | 411 | 513 | 427 |

Source: Segendorf and Jansson (2012).

PAYMENTS AT THE POINT-OF-SALE

Cash, debit cards and credit cards are currently the payment instruments that are used to make payments at the point-of-sale. The agents that have costs in connection with cash payments are the Riksbank, cash-in-transit companies, banks, businesses and consumers. In the case of card payments, only the latter three agents incur costs.

Table 2 presents the private costs, fees and social costs for cash payments in the form of consumed resources and net costs, as in the example in Chart 1. The private costs are presented in the central column in the table. To the left of the central column we deduct the income an agent has earned in the form of fees and seignorage and thus arrive at the net cost that reflects the profitability of cash operations. To the right of the central column we deduct the fees paid from each agent's private costs and thus arrive at the resources that each agent has consumed. Both the total for net costs and the total for consumed resources show the social costs of cash and we can also see that the totals in the left and right columns are the same. The only difference between the columns is that the respective costs are distributed in different ways between the parties. The right-hand column shows where the resources have been consumed while the left-hand column shows the net cost of a certain sector. A negative net cost for, for example, the Riksbank, entails a corporate profit.

7 This study used a method developed and applied in collaboration between 13 European central banks under the coordination of the European Central Bank (ECB). It means that cost calculations from different countries can be compared for the first time.

8 For a description of the method, cost data and results, see Segendorf and Jansson (2012).

9 For a definition of debit cards and credit cards, see footnote 4.

Table 2. Cost of cash payments in Sweden in 2009, SEK million

| | NET COST | FEES RECEIVED | SEIGNORAGE RECEIVED | PRIVATE COSTS | SEIGNORAGE PAID | FEES PAID | CONSUMED RESOURCES |
|----------------|--------------|------------------|------------------------|------------------|--------------------|--------------|-----------------------|
| The Riksbank | -5 566 | 6 | 5 800 | 240 | | 30 | 210 |
| CITs | -20 | 1 650 | | 1 630 | | 6 | 1 624 |
| Banking sector | 2 090 | 1 270 | | 3 360 | 540 | 350 | 2 470 |
| Retailers | 6 720 | | | 6 720 | 620 | 1 820 | 4 280 |
| Consumers | 5 380 | 50 | | 5 430 | 4 640 | 770 | 20 |
| Sum | 8 604 | 2 976 | 5 800 | 17 380 | 5 800 | 2 976 | 8 604 |

Note. Both the column *net cost* and the column *consumed resources* add up to the social costs. The two columns therefore represent different ways of illustrating who bears the costs.

Source: Segendorf and Jansson (2012).

In the case of the Riksbank, the private costs amounted to SEK 240 million and the largest cost items were for the purchase of new banknotes and coins and storage. Seignorage amounted to SEK 5.8 billion, SEK 4.6 billion of which came from the consumers while the remaining SEK 1.2 billion was more or less evenly divided between banks and companies. Most of the cash-in-transit companies' private costs of SEK 1.6 billion arose in connection with transport and with cash management at the depots. Their income amounted to just over SEK 1.6 billion, of which the banks paid approximately SEK 350 million and the corporate sector around SEK 1.3 billion. The banks' largest private cost of almost SEK 3.4 billion stemmed from withdrawals and deposits. Part of this sum consisted of fees to the cash-in-transit companies and seignorage. The fees received by the banks consisted of fees from the corporate sector of almost SEK 500 million and of fixed card fees from consumers of SEK 770 million. Here we have divided the consumers' fixed fees for cards between cash withdrawals and card payments in proportion to the number of transactions. For their part, the businesses had substantial costs in the form of fees and personnel costs for receiving payments over the counter and checking the takings at the end of the working day. Personnel costs comprise wage costs including social security contributions of SEK 1.8 billion, calculated on the basis of over one billion cash payments which in 2009 took an average of approximately 26 seconds each. The costs for checking takings and other back-office activities amounted to approximately SEK 2.1 billion. The major costs for consumers related to seignorage, fees to the banks and the time required to make the cash payments.¹⁰ The total social cost of cash payments thus amounted to SEK 8.6 billion, which gives an average cost per cash payment of SEK 8.30. Real resources are mainly consumed in the corporate sector, but also banks and, to a lesser extent, cash-in-transit companies, consume resources when managing cash payments. However, the Riksbank and the consumers consume very little real resources. On the other hand, the distribution of net costs is different. Here the Riksbank makes a considerable profit (negative net cost) due to

¹⁰ The consumers' time cost has been calculated using a model in which the time cost is a function of the interest rate and the number of payments and withdrawals. The time cost was low in 2009, in part due to the low interest rate in this year. See Segendorf and Jansson (2012) for a discussion of this.

the income from seignorage, while the corporate sector and the consumers bear the major part of the costs. The banks also make a loss on their cash operations.¹¹

Tables 3 and 4 present the costs for payments using debit cards and credit cards. In the case of payments using debit cards, the management of payments vis-à-vis companies, including costs for IT and communication, represented the banks' largest cost item. Other large cost items were customer services, the authorisation of payments and other checks. In the case of credit cards, there were also costs for marketing, credit assessments and more extensive customer services including bonus programmes. Income consisted mainly of fees from businesses and consumers and transaction charges from companies. The average fee amounted to almost SEK 0.80 for payments using debit cards and SEK 7.30 for payments using credit cards. Note the substantial difference in the profitability of the banks (negative net cost) for debit and credit cards in the tables.¹²

The businesses' major costs comprised fees to the banks and the time taken to receive payments over the counter. It was estimated that a card payment takes 25 seconds. In the case of debit cards, the time cost was the highest at approximately SEK 2.3 billion, while fees amounted to almost SEK 1.4 billion. The situation was the reverse for credit cards where the fees were much higher (just over SEK 2 billion) than the time cost (just over SEK 400 million). The major cost item for the consumers was the fixed fees paid to the banks, while their time cost, as in the case of cash, was negligible.

The social costs for payments using debit and credit cards amounted to almost SEK 6 billion and SEK 2.8 billion respectively. The average social cost for a debit-card payment was thus just under SEK 4.50 and for a credit-card payment SEK 11.70. The considerable difference is partly explained by the advantages of scale that the larger number of debit-card payments entails compared with the relatively few credit-card payments.

Table 3. Cost of debit-card payments in Sweden in 2009, SEK million

| | NET COST | FEES RECEIVED | PRIVATE COSTS | FEES PAID | CONSUMED RESOURCES |
|----------------|--------------|------------------|------------------|--------------|-----------------------|
| The Riksbank | | | | | |
| CITs | | | | | |
| Banking sector | 230 | 3 240 | 3 470 | 40 | 3 430 |
| Retailers | 3 890 | | 3 890 | 1 380 | 2 510 |
| Consumers | 1 840 | 70 | 1 910 | 1 890 | 20 |
| Sum | 5 960 | 3 310 | 9 270 | 3 310 | 5 960 |

Source: Segendorf and Jansson (2012).

11 We wish to underline the fact that whether the banks make a loss or not is highly dependent on whether one chooses to include the net interest income from the current accounts that the public have with the banks. If this is included the banks make a substantial profit. For further discussion, see Segendorf and Jansson (2012).

12 As in the case of cash, we have not included net interest income for current accounts. If net interest income is included, the profitability of debit cards increases significantly, see Segendorf and Jansson (2012).

Table 4. Cost of credit-card payments in Sweden in 2009, SEK million

| | NET COST | FEES RECEIVED | PRIVATE COSTS | FEES PAID | CONSUMED RESOURCES |
|----------------------|--------------|------------------|------------------|--------------|-----------------------|
| The Riksbank CITs | | | | | |
| Banking sector | -650 | 3 490 | 2 840 | 490 | 2 350 |
| Retailers | 2 470 | | 2 470 | 2 010 | 460 |
| Consumers | 990 | 490 | 1 480 | 1 480 | 0 |
| Sum | 2 810 | 3 980 | 6 790 | 3 980 | 2 810 |

Source: Segendorf and Jansson (2012).

The social cost of cash payments is thus largely the same as the joint social cost of debit-card and credit-card payments. However, the average cost is significantly higher for a cash payment (SEK 8.30) than for the weighted average cost of a debit or credit-card payment (SEK 5.50). This difference is due to the fact that the economies of scale are greater for card payments than for cash payments.

Below we discuss whether the Swedish payment system is efficient. We begin by investigating whether the costs in Sweden are reasonable in an international perspective.

THE SWEDISH PAYMENT SYSTEM IS EFFICIENT IN AN INTERNATIONAL PERSPECTIVE

The costs of payments and the efficiency of the payment system have been studied in several countries. In this article we focus on comparisons with countries that are similar to Sweden and with countries that have applied the same calculation method as that used to calculate the Swedish costs. The Swedish study is part of a coordinated programme involving 13 national central banks in the EU and the ECB. So far, only Denmark and Hungary have published national reports following this programme. It is therefore natural to compare Sweden with these two countries as their results are directly comparable.

There are also other studies that have used a somewhat different method to calculate the costs of payments. The difference between these studies and those coordinated by the ECB mainly relates to what costs the studies have chosen to include. The results of the different groups of studies are not therefore directly comparable, but can nevertheless be used to give an indication of the differences between countries. Two studies that are appropriate for comparison are those conducted by Gresvik and Haare (2009) in Norway for 2007 and by Bergman et al. (2007) in Sweden for 2002. Table 5 summarises the different results for payments using cash and cards where we have chosen to add together the costs for payments using debit and credit cards.

Table 5. Costs for card and cash payments, comparison between four countries, SEK at 2009 value and exchange rate

| | | 2002 | 2009 | | | 2007 |
|---------------|-----------------------------|--------|--------|---------|---------|--------|
| | | SWEDEN | SWEDEN | DENMARK | HUNGARY | NORWAY |
| Cash | Social cost (SEK, billions) | 7 206 | 8 604 | 8 260 | 7 911 | 4 248 |
| | Share of GDP (%) | 0.27 | 0.28 | 0.38 | 0.8 | 0.15 |
| | Social unit cost (SEK) | 5.16 | 8.32 | 10.5 | 2.79 | 8.59 |
| Cards, total* | Social cost (SEK, billions) | 2 098 | 8 770 | 5 166 | 1 886 | 6 513 |
| | Share of GDP (%) | 0.09 | 0.28 | 0.24 | 0.19 | 0.23 |
| | Social unit cost (SEK) | 3.52 | 5.55 | 5.89 | 10.78 | 7.21 |

*Includes card payments at the point-of-sale and remote payments using debit and credit cards.

Sources: Danmarks Nationalbank (2012), Turján et al. (2011), Grevik and Haare (2009), Bergman et al. (2007), Segendorf and Jansson (2012), Statistics Norway (national accounts), Norges Bank and ECB Statistical Warehouse.

The comparison shows that it is completely reasonable for Sweden to have social cost for cash of between SEK 8 and 9 billion, which corresponds to approximately 0.3 per cent of GDP. This conclusion is also in line with other studies.¹³ A social cost of SEK 8 to 10 per payment (unit cost) for cash payments also appears to be normal.

Hungary deviates in this respect in that it has higher costs measured as a percentage of GDP and a lower average cost per payment. The reason for this is that the use of cash is much more prevalent in Hungary than in the other countries. Norway, on the other hand, has lower costs in terms of both absolute costs and as a percentage of GDP. The probable reason for this is that cash is used to a lesser extent in Norway than in the other countries, which reduces these costs. However, the average cost of a cash payment in Norway is in line with the corresponding costs in Sweden and Denmark in 2009. It should also be added that Norway has worked methodically for a long time to improve the efficiency of its payment system.

The average cost in Sweden increased between 2002 and 2009, which was due to a fall in the number of cash payments in this period. This reflects the fact that the use of cards is increasing in Swedish society, but is also due to differences in the methodologies used in the studies. The 2002 study also includes payments between private individuals, while the calculations for 2009 are based only on the number of payments from consumers to companies and authorities.

It also appears that a cost for card payments in relation to GDP of between 0.25 and 0.30 per cent is reasonable. At first glance, the level seems to be somewhat high in Sweden compared to the other countries, but not when examined more closely. This is due to the fact that the corresponding cost in Hungary is low as the use of cards is limited there. In Denmark, on the other hand, a national debit card (Dankort) is widely used, which leads to lower costs. Dankort cannot be used abroad, however, unlike most of the Swedish cards which are linked to global card systems such as VISA or Master Card. Norway also has a national card system (Bank Asept) and, furthermore, has a higher GDP per capita than

¹³ In general it is regarded as normal to be in the interval 0.3-0.4 per cent of GDP, but the level may sometimes be higher. In the Netherlands, the cost for cash was estimated to be approximately 0.48 per cent of GDP in 2002, see Brits and Winder (2005).

Sweden. It is thus not remarkable that the Swedish costs correspond to 0.28 per cent of GDP. The social unit cost for a card payment is, on the other hand, relatively low in Sweden. It is in line with the corresponding cost in Denmark and is slightly lower than in Norway.

The social costs for cards were higher in 2009 than in 2002 but, as in the case of cash, the difference is largely due to differences in methodology in that fewer types of cost were included in the study from 2002 than in the study from 2009.

All in all, there is nothing to indicate that Sweden's payment system is less efficient than the systems in the other countries in the comparison above. When more of the countries that have participated in the coordinated study publish national reports and the ECB presents a comparative study, the possibility to compare Sweden with other countries will increase.

CASH IS USED TOO MUCH

At the start of this article, we discussed the various types of infrastructure needed for cash and card payments and the existing economies of scale. The infrastructure for cash payments is mainly logistical, while that for card payments consists of IT systems. Not unreasonably, the cost of "producing" an additional payment differs between these two systems.

One example is the time cost. Examining our data from 2009, we find that an average card payment takes 25 seconds, irrespective of the amount of the payment. The average cash payment takes 26 seconds, but for smaller amounts, for example SEK 10 or SEK 20, it is probably faster, particularly if the exact amount is handed over. On the other hand, for payments of larger amounts, for example SEK 1 367, where a number of different denominations must be used, either handed over to the payee or as change returned to the payer, it can take longer to pay by cash than by card. Cash also requires more work for checking takings and may entail time spent queuing at ATMs.

The average time for a cash payment thus increases in line with the amount of the payment, while the time for a card payment remains the same regardless of the amount. As time has a value for all of the parties involved in both cases, the economic cost of carrying out a card payment thereby remains the same, in principle, regardless of the transaction amount, while the economic cost of a cash payment increases with the transaction amount. Consequently, there should be a threshold value for the transaction amount at which the cost for a cash payment is the same as for a card payment. For transaction amounts below this threshold, it would be cheaper, from a social perspective, to pay in cash, while, for those above the threshold it would be cheaper to pay by card. Below, we calculate these cut-off points between card and cash payments and contrast these with how consumers actually pay.

As the costs of a debit or credit-card payment do not depend on the amount of the transaction, we have set these at the same level as the average social cost, which is to say SEK 4.50 for payments with a debit card and SEK 11.70 for payments with a credit card. For cash payments, we have divided the social costs (SEK 8.6 billion) into fixed costs and

variable costs, where the variable costs are those that change when the total value of cash payments in the economy changes, for example the time cost. The fixed costs, which are thus not dependent on cash usage include, for example, costs for designing banknotes, certain costs for security and storage etc.¹⁴ We have divided up the fixed costs per the number of cash payments, and the variable costs on the basis of the total value of all cash payments. This gives us a simple equation that expresses the cost of a cash payment as a linear function of the value of the cash payment – see equation (1), where v is the value of the payment.

$$f(v) = \frac{\text{fixed costs}}{\text{number of payments}} + v \times \frac{\text{variable costs}}{\text{total value}} \quad (1)$$

The fixed costs of cash payments in 2009 amounted to SEK 4.25 billion, and the variable costs to SEK 4.35 billion. The number of cash payments and their value is given in Table 1.

The calculated economic cost of card payments and cash payments is illustrated in Figure 1. As we described earlier, the cost of a card payment remains constant, irrespective of the transaction amount, and thus the cost functions of debit and credit-card payments run parallel to the figure's x axis, which expresses the payment's value. In contrast, the cost of cash payments increases with the value of the payment. The slope of the cost function of cash payments is thus given by the second fractional expression on the right-hand side of equation (1). The intercept on the y axis is given by the first fractional expression. The threshold value for cash and debit-card payments is given by the intersection between the cost function for cash payments and the cost function for payments using debit cards. We can see that cash payments are less expensive from society's point of view for payments below SEK 20. Similarly, the threshold value for cash and credit-card payments is SEK 450, that is below this value cash payments are socially less expensive than credit-card payments.¹⁵

14 See Segendorf and Jansson (2012) for a more detailed description.

15 In Denmark in 2009, Jacobsen and Pedersen (2012) found that the economic cut-off point between cash payments and payments made using the domestic debit card (Dankort) was DKK 29, which is equivalent to SEK 41. The cut-off point between cash payments and debit-card payments in Sweden in 2002 was SEK 72, see Bergman et al. (2007). One reason why this cut-off point has shifted downwards over time is that the economies of scale in the card system have been exploited to a greater extent. The use of cards in Sweden increased from 66 card payments per capita in 2002 to 182 in 2009. There are many indications that the use of cash declined in the same period.

Figure 1. The economic cost of different payments as a function of the transaction amount

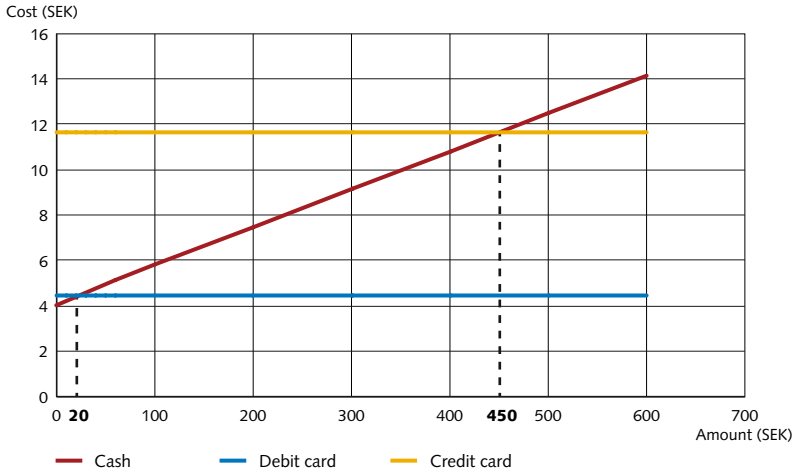


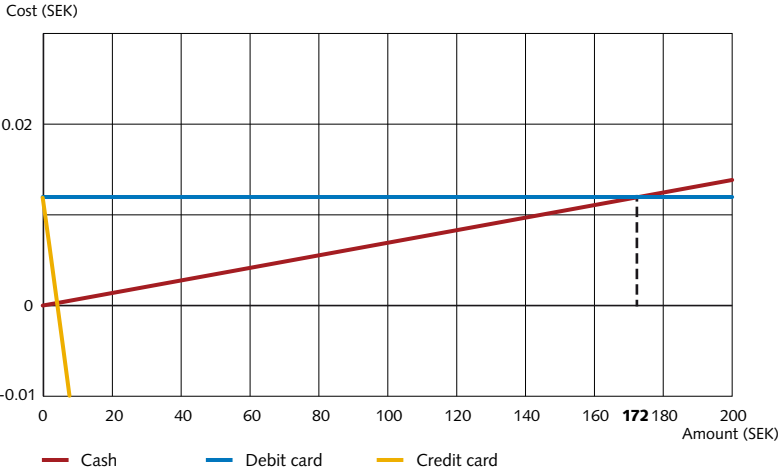
Table 1 shows that the average value of a cash payment is SEK 252. Considering the threshold values in Figure 1 and the fact that credit cards are used to a limited extent by consumers, this indicates that Swedish consumers use cash too much as the average value of cash payments is so much higher than a weighted average of the threshold values.¹⁶ Put another way, we can say that the consumers use debit cards to little. We can also note that the average cost of a credit-card payment is always higher than the cost of a debit-card payment irrespective of the transaction amount, which means that from a social point of view credit-card payments should be avoided altogether.

Can we explain the consumers' choice of payment method by studying what economic incentives they have to choose one method rather than another? The consumers almost never have to pay any transaction charges or charges for withdrawals from ATMs. We therefore assume that neither the use of cash nor the use of cards is associated with any charges to the consumer at the point-of-sale. The cost to the consumer is thus determined by the time it takes to make the payment. In the case of cash payments, this time is worth SEK 20 million per year (see the item Consumed resources in Table 2). Divided by the total value for all cash payments this gives the slope of the cost function for cash payments. In the case of card payments, we divide the corresponding value by the number of card payments as the time taken does not depend on the size of the payment. For credit cards there is also an income in terms of an interest-free loan. A purchase is paid for after an average of 45 days and the consumer pays no interest during this period – in 2009 the average short-term lending rate was 2.35 per cent. This means that the cost function for credit cards has a negative slope; that is it becomes increasingly economically favourable to pay with a credit card the higher the sum to be paid is. Figure 2 shows that the private

¹⁶ Table 1 shows that 15.4 per cent of card payments are made using credit cards. If we weigh together the threshold values for debit cards and credit cards with their respective percentages of the volume of card payments we get SEK 86.

threshold value between debit-card and cash payments is SEK 172, while between credit-card and cash payments it is only SEK 4.

Figure 2. The private cost of different payments as a function of the transaction amount



The social cut-off points in Figure 1 show how the consumers should behave from the point of view of the economy as a whole, while the private cut-off points in Figure 2 show how the consumers should behave given the economic incentives they have. The figures show that there is a considerable gap between the social cut-off points and the private cut-off points. The consumers thus have no economic incentives that promote the efficient use of the payment system. The cut-off points between cash payments and debit-card payments indicate that we should expect cash to be used to a significantly greater extent than is socially desirable.

COULD A MORE EFFICIENT PAYMENT SYSTEM BE ACHIEVED WITH TRANSACTION CHARGES?

In this article, we have demonstrated that the social costs of payments made by card and cash at points-of-sale in Sweden in 2009 amounted to SEK 17.3 billion (see Table 5). This was equivalent to 0.56 per cent of Sweden’s GDP in the same year, which is in line with the situation in other comparable countries. To minimise the social costs, cards should have been used instead of cash for payments exceeding SEK 20. However, the average cash payment amounted to SEK 252. In other words, Swedish consumers are using cash too much in comparison with the level that would minimise costs to society for these types of payment.

From these results, we can conclude that the use of cards and cash in the Swedish payment system is relatively efficient, but that there is potential to save even more of society’s resources by encouraging consumers to use their debit cards more often. How to do this is a more open question, however. To a large degree, it is a matter of increasing consumers’ private economic incentives to act in a more efficient manner in terms of the

economy as a whole. One method of achieving this would be to introduce cost-based transaction charges. The idea is to allow prices to reflect the cost of producing services or goods, as already happens on most markets.

However, on the Swedish market for card and cash payments, there are few or no such price signals at present. Even so, experience from Sweden and Norway indicates that consumers are sensitive to such price signals. In Sweden, payments by cheque were priced at the start of the 1990s, after which cheque payments decreased rapidly.¹⁷ Over-the-counter payments at bank branches have also long been subject to a charge, and few bank customers choose to pay in this way today. Instead, they pay via online banking or by postal credit transfers. A further indication that Swedish customers are sensitive to economic incentives is provided by a study by Bergman et al. (2007), which finds that the consumers' use of cards and cash coincides strongly with their private economic incentives.

Experience is similar in Norway, where a system using cost-based transaction charges to a greater extent was introduced a little over 20 years ago. Norwegian statistics show that direct transaction prices covered about 20 per cent of the variable costs in 1988. By the end of the 1990s, this figure had increased to around 60 per cent. A study by Humphrey et al. (2001) uses Norwegian data from this period and shows that the choice of payment method is largely governed by price. So there is good reason to believe that cost-based transaction charges among banks and businesses could increase the efficiency of the payment system.

However, there are a number of potential problems with the introduction of transaction charges. First, it is difficult to design these charges in a way that makes it rational for the separate banks and businesses to introduce them individually. Being first to introduce transaction charges would probably entail a significant cost in terms of dissatisfaction among customers and impaired competitiveness. Banks and businesses would probably find themselves caught in a 'prisoner's dilemma' in which nobody wants to be first to introduce charges, even though this would be best for all.^{18, 19} One possible solution may be to make hidden charges visible, which is feasible because today's consumers largely contribute towards funding payment services in an indirect way, for instance through low interest rates

17 In 1990, every seventh transaction was paid for by cheque. Cheque payments accounted for just over one-tenth of the value of non-cash payments. One bank introduced a charge of SEK 15 and other banks followed suit. In just a few years, the greater part of cheque usage disappeared. Today, cheque payments account for only about one tenth of a per cent of both the value of the payments as well as the number of transactions. See Nyberg (2008).

18 The prisoner's dilemma is the name of a classic decision-making problem in game theory. The problem can be described by supposing a situation in which two people have committed a crime and are sitting in custody, each in their own cell with no possibility of communication. Each prisoner has the possibility to testify against his companion or to remain silent. A betrayal would shorten the prisoner's own sentence, but if both choose not to testify they will receive a significantly shorter sentence or even be released due to lack of evidence. Collectively, it is more beneficial for the prisoners not to betray each other, while individually it is more rational for each prisoner to testify against his companion. If both parties are uncertain of what the other will do, they will each look to their own interests and take the course of action that is individually rational, which will result in them receiving longer sentences than if they had chosen not to testify against each other.

19 The banks in Norway introduced cost-based transaction charges individually with the support of Norges Bank. The fact that the large banks were first to introduce this type of charge probably made it easier for the smaller banks to follow suit.

on current accounts. Consequently, the banks would not have to increase their revenues but only redistribute them from hidden to visible charges. In such a situation, it is possible that consumer distrust could be overcome if consumers can simultaneously be convinced that they will not be paying more in total, but will be compensated in other ways, such as through better interest rates on current accounts and lower prices in the shops. However, it is not easy to see how this could credibly be achieved. This solution would be further obstructed by the fact that there is a cost associated with levying a transaction charge and that introducing a transaction charge would thus not always be economically motivated in the cases where the service is cheap to produce and the charge consequently very low. However, this problem can be solved by *packaging* the payment services (often called *bundling*), so that a customer gets access to one or more payment services for a fixed price over a certain period.²⁰ The net interest income the banks earn on the current accounts can also be considered to be an indirect charge. However, we are fairly certain that this indirect charge is neither sufficiently transparent nor clearly linked to the use of payment services to give consumers the incentive to use payment services in an economically-optimal way.²¹ This means that indirect funding via net interest income should be replaced by direct funding through charges, either by way of period fees or through transaction charges, depending on the circumstances.

The Riksbank's investigation also reveals that the consumers' choice of payment method is habitual to a certain extent (see Segendorf and Jansson (2012)). The use of cash increases with age and is more common among men, while card usage increases with income, education and the size of both the place of residence and the household, and is more common among women. Transaction charges would thus probably have to be complemented by other measures aimed at different groups of consumers. For example, this could be a matter of discretely influencing behaviour (known as *nudging*), which has proved to be effective in other contexts in attempts to influence attitudes and behaviour by presenting different alternatives in various ways. In the case of cards and cash, for example, the consumers' choice of payment method could be influenced with the aid of appropriately-designed information in shops about the charges shops pay to the banks for various payment services. Another possibility would be to introduce a charge on one payment method as a discount on another payment method.²² Experience from the United States, the United Kingdom and Denmark indicates that nudging can have significant

20 This is a common pricing method for the private customers of Swedish banks. Online banking services and debit cards are often combined.

21 The banks usually levy most of the charges on companies, for example in the form of transaction charges. In general, card payments generate a surplus for the banks, while cash gives rise to a deficit. See Guibourg and Segendorf (2007) for a more detailed analysis of the Swedish banks' pricing.

22 One possible example of Swedish nudging can be found in Chapter 5, Article 1 of the Payment Services Act (2010:751), which forbids Swedish businesses from demanding charges for non-cash payments, for example for credit cards, but permits discounts. Discounts and charges are equivalent in this context, as the same price structure can be attained via both discounts and charges. It is possible that the word 'discount' is used rather than 'charge' due to the negative associations of the word 'charge'.

effects in certain situations such as energy conservation, littering and pension saving.²³ However, this is a relatively new approach to the problem of optimal choice of payment method and thus needs to be studied more closely. In the meantime, nudging should be seen as a complement to cost-based transaction charges and a way of making it possible to introduce these charges.

23 The Economist (2012) provides a lucid introduction to the concept of nudging and presents a number of interesting examples of it.

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